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Factsheet

COMMON DISORDERS OF BROAD-LEAVED TREES

(Revision of Factsheet "Common Disorders of Broad-Leaved Trees", July 1977)

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INTRODUCTION

Deciduous trees are an integral part of many landscapes. Trees function as windbreaks, barriers for property lines, and also provide privacy, shade and aesthetic value to the home or cottage. Occasionally, however, trees are planted in less than ideal sites or conditions around established trees are modified in a detrimental way. If adverse conditions persist, the health of such trees may be at risk.

When trees are not growing vigorously, stresses such as adverse environmental conditions, and insect and disease activities can weaken trees and cause them to decline. It is important to recognize and identify the cause of stress in trees, so that with early implementation of remedial measures, tree vigour can be improved.

DIAGNOSING THE PROBLEM

The first task in identifying disorders of broad-leaved trees is to determine whether the stress is biotic or abiotic in nature. Biotic stresses are caused by insects, mites, disease (ie. bacteria, fungi, and viruses), animals or other living organisms. Abiotic stresses are caused by non-living factors such as the soil a tree has been planted in, weather conditions or the overall growing conditions.

Biotic Stresses When looking for damage caused by insects, examine the affected tree carefully for signs of insect infestation. Affected areas of the tree may contain insects or signs of their activity. For example, many wood–boring insects create sawdust during their tunneling activity. The sawdust may remain within the tunnels or collect at the base of the trunk. Some insects such as the Gypsy moth leave empty cocoons behind after emerging as adults. Other indications of insects include egg cases, webbing, faeces, curled leaves or honey-dew (a sticky secretion) that is produced by sucking insects such as aphids, leafhoppers, and scale insects.

When checking for disease, examine twigs for sunken areas (cankers) or raised, blister-like structures (fungal fruiting bodies). It is advisable to cut off an affected twig, and check the inner wood (vascular tissue) for brownish discoloration. Healthy wood color ranges from greenish-white to creamy-yellow. Foliar disease symptoms include discolored spots and blotches, discolored veins and pin–head size black or brown fruiting bodies along the veins or on the surface to the leaves. (Note: some insects will produce galls that resemble fungal structures.)

Animals can damage trees by feeding directly on the tree or by foraging for insects in the bark or wood. Squirrels can prune new growth from elm, maple and oak during spring foraging. A tell-tale sign of this activity is large bunches of healthy leaves littering the ground. Many animals including mice, porcupines and some birds will remove bark to feed on the tender underlying cambium layer. This damage is often noticed on thin-barked trees at ground level or on the main trunk. When a section of bark is removed in a ring around the tree this damage is referred to as **girdling injury.** Girdling is also the term used when a vine, root, rope or cable encircles another root, stem or trunk and slowly constricts it over time. Animal girdling injury can be recognized by uneven tearing of the bark in the damaged area, teeth marks and a general sparseness or dieback of the crown above the injured area.

Abiotic Stresses These types of stresses are usually more difficult to recognize and correct than biotic stresses. When assessing what is affecting the growth of a tree, it is important to not only examine the damaged portion of the tree, but also the rest of the tree as well. Check the surrounding vicinity and examine other plant species to see if they are showing similar symptoms. Try to establish if the stress affecting the tree has been occurring for some time or if it appeared suddenly. Be sure to assess the soil, local weather conditions, and any recent activities that have occurred around the tree (e.g. construction, pesticide application, grading etc.).

Four general factors can be examined when assessing what is affecting tree growth. These are soil, hardiness, environmental stresses and human activities.

SOILS

The quality of soil in which a tree grows is one of the most important factors affecting tree health. Soil conditions including the amount of organic matter, pH (reaction), nutritional status, porosity and aeration will all have a direct effect on tree health.

Drainage The survival and growth of tree roots is very dependent on soil drainage. Soil drainage affects oxygen availability to the roots and is necessary for normal root growth and nutrient uptake. The drainage of a soil can be affected by many factors including texture (clay, silt or sand), mineral composition, amount of organic matter and the local water table.

Roots growing in a poorly drained soil will be deficient in oxygen and have limited nutrient uptake. If soil saturation is continuous, root–hairs will die and the tree will become an easy target for root–rot organisms. The tree will then begin to desiccate (even though water is available), and will start loosing leaves and small branches.

Trees that are growing in gravel or sandy soils that do not retain water well may also show symptoms of drought during dry spells or periods of excessively hot weather. Lack of moisture will also be a problem where soils are severely compacted, as the water will tend to run off the surface instead of percolating down through the soil. If the water table drops because of excavations, additional wells or high water usage, drought symptoms (dry, brown margined leaves) are possible.

ph (Reaction) Soil pH is a measure of acidity or alkalinity of a soil. A soil pH reading above 7.0 is alkaline or basic and below 7.0 is acid. Most plants grow well in soils with pH values of 6.0 to 7.5. Most of soils in Southern Ontario are neutral (7.0) to alkaline. If the soil is too alkaline, this may have an influence on the uptake of some nutrients (eg. iron and manganese). To increase the alkalinity of a soil, dolomitic limestone can be applied. To lower alkalinity, sulphur can be applied.

Iron (Fe) and Manganese (Mn) deficiencies Deficiencies of iron and manganese may occur in trees that are growing in alkaline soils. Trees that commonly exhibit these deficiencies include red maples, oaks, tulip trees, rhododendrons and azaleas. Affected trees will have foliage that is pale green or yellow with dark green veins.

HARDINESS

The ability of a tree to withstand cold temperature is called hardiness. Hardiness varies with tree species, and because of this all plants are assigned a numerical hardiness rating.

In Ontario there are 7 hardiness zones. These zones are based on a number of factors including minimum temperature during the winter, the number of frost-free days, summer rainfall and wind conditions. Areas in the north are given a lower hardiness rating or number. This rating generally increases as one continues south.

It is important to know the zone your property is in, as well as the hardiness rating of the tree. A tree that has a higher hardiness rating than the area it is planted in may not survive. If such a tree does survive, it is more likely to be affected by environmental stresses, and it may sustain injury in the form of branch dieback, severe trunk cracks, desiccation of foliage (as seen in broad-leaved evergreens such as holly and Oregon grape) and root freezing. Such injuries will leave a tree susceptible to attack from insects and disease.

Hardiness ratings are meant as guidelines only. Plants growing beyond their hardiness rating do so if their microclimate has been somewhat modified.

The hardiness of a particular tree will also vary with the season, maturity of tissue, and with cultural practice. Cold hardiness increases as the fall progresses and decreases over the spring to a very low level in the summer. Many plants can be severely damaged by extreme temperature fluctuations (e.g. early fall frosts or late spring frosts).

Many nursery and garden centre catalogues will list a hardiness rating along with a description of the tree. Hardiness zones of many popular trees can also be found in Ontario Ministry of Agriculture and Food (OMAF) Factsheets *Low Maintenance Landscape Plants*, Agdex 274 and *Selecting Trees for Landscape Plantings*, Agdex 275/17

ENVIRONMENTAL STRESSES

Environmental stresses refer to stresses that have been caused by weather conditions or other natural factors. Some of these are as follows:

Winter Injury Winter injury is perhaps one of the hardest common disorders to diagnose due to the different forms of injury that can occur (listed below). Although repeated freezing and thawing will cause damage to plant tissues, it is the formation of ice crystals within the cells of buds, sapwood and cambium that causes the real damage. When ice crystals form in a plant cell, the cell membrane is ruptured and the contents are lost. If many cells are ruptured, tissue death will result.

Winter injury may be caused by the following factors:

- extreme temperature fluctuations.
- extreme low temperatures.
- winter burn or desiccation.

Possible symptoms caused by winter injury:

- buds fail to open in the spring
- buds open, but the leaves are smaller than normal, brown and may wilt by the early summer.
- sunscald - splitting of bark revealing inner wood. This will appear on the south and southwestern exposure and is caused by the rapid freezing and thawing of the underlying tissue.
- twig dieback.
- browning of foliage (winter burn) especially in broad-leaved evergreens. This occurs when roots which are in frozen soil, are unable to replenish the moisture that has been lost from plant tissues, due to desiccation by the wind. This damage is noticed in early spring when temperatures begin to warm up.

Note: Winter injury may not be noticed until the early summer when it can be confused with other abiotic or biotic stresses.

Lightning Injury Tall trees growing in exposed locations such as open fields, hill tops and along fence rows are more likely to be struck by lightning than those trees growing in groups or low-lying areas. However, no tree is exempt from lightning damage. The severity of lightning damage varies depending on the directness of the strike and the strength of the charge. Typical symptoms of lightning damage include large strips of bark and inner wood being blown out, or large portions of a tree suddenly turning brown after a recent electrical storm. As lightning has an enormous amount of electrical energy, this energy must be grounded through the tree into the soil. This energy will sometimes kill an area of cambium that will result in adventitious root growth (air roots) or a large clump of soil or roots will be disturbed where the electrical energy left the tree.

To minimize stress caused by lightning strikes, remedial measures are recommended. Remove long strips of bark with a clean sharp knife so that callus tissue can repair the

damage. Root growth can be encouraged by fertilizing with a blend that is high in phosphorous, but low in nitrogen.

Wind Damage The damage usually associated with strong winds is broken and torn branches (similar damage can also be caused by lightning). Shallowly rooted trees are also susceptible to strong winds and complete uprooting of these trees can occur. Weak-wooded , fast growing trees such as willows and poplars, are especially vulnerable to high winds, since they have large crowns with dense foliage that can easily "catch" the wind. Branch and trunk breakage is more likely to occur on trees infected with wood decay. High winds can also desiccate, damage or tear off leaves. Affected leaves appear tattered with large missing portions, and occasionally the margins will be scorched. These symptoms are more severe in drought stressed trees.

Hail Hard driven hail can cause serious injury to a tree especially in young succulent tissues. Hail damage is recognized by severely shredded leaves and a large number of "pock" marks on twigs and branches that later heal, leaving many small callused scars. Severe callusing can result in a branch becoming partially girdled and eventually dieback will occur. These wounds may in turn provide entrances for insects and disease causing organisms.

Ice and Wet Snow Large amounts of ice and wet snow that accumulated after a winter storm can be heavy enough to cause branches to snap. Small trees that still have a few leaves attached can easily be be broken from the weight of snow and ice. The homeowner can help prevent this injury by properly staking small trees, and removing snow and ice from larger specimen trees (within reason) with a broom.

Competition from Other Plant Species As a tree grows, a network of roots extend in the upper 1 metre of the soil, and well beyond the spread of the crown. The small root hairs covering each root absorb water and nutrients from the upper 30 cm of soil. It is in this zone that the roots of turf and other plant species are also competing for food and water. If a tree does not get enough nutrients it will begin to show deficiency in the leaves. Affected leaves may appear pale green in the case of nitrogen deficiency or purple-red in the case of phosphorous or potassium deficiency. A soil test is often the most efficient way to discover if the soil around the tree is deficient in nutrients. When nutrient and pH levels are normal, misapplied pesticides or other stresses may be causing the discoloration

Drought Trees may suffer from both short-term and long-term drought stress. The leaves of trees that are experiencing short-term drought stress will tend to wilt during the hottest part of the day, and later the leaves will develop margins that are brown and brittle. This damage will be more severe if strong breezes are present. Long-term drought stress will show short-term symptoms as well as the development of premature fall color and defoliation in midsummer.

Trees growing in clay soil may suffer longer periods of drought because sun baked clay soil particles tend to swell-up at the surface when wetted, blocking further moisture from reaching the roots. Aeration of the area under the dripline may help prevent this problem.

As trees are perennial plants they are subject to winter drought as well. The soil around the tree should be well watered in the fall so that the roots will have a good "reservoir" of water to resume growth the following spring.

HUMAN ACTIVITIES

Every year many trees are killed or damaged indirectly by human activities. In this section stresses are listed along with common activities that contribute to them.

Construction Stress

Trenching and excavation activities within the root zone of trees will damage roots, causing a reduction in the uptake of moisture and nutrients. This will eventually cause leaf scorch and dieback in the crown. Trees that have had many roots severed or injured by excavation equipment may also set large amounts of seed from time to time. Although some trees will naturally set heavy crops in alternate years, heavy fruit formation may also be a stress-related condition due to physical damage to the root or trunk. Trees that may set large amounts of fruit when under stress include maples, ash, birch and elm.

The movement of heavy machinery or the installation of driveways, side walks or patios over the root zone can cause soil compaction. Compaction of the upper few inches of soil especially in a clay will result in oxygen and water depletion in the root zone. Tress that are growing in compacted soil will show drought stress.

Improper Maintenance

Application of large amounts of fertilizer in late summer results in the failure of branches and bark to harden-off sufficiently before winter. Trees that have not had sufficient time to harden-off are generally more susceptible to winter injury.

Over-fertilization during the growing season will cause excessive suckering, and may reduce flowering and fruiting ability of some trees.

Improper pruning techniques that leave large stubs and torn bark will leave a wound vulnerable to pathogens of environmental stresses.

Transplanting stresses

There are a number of stresses that can affect a tree before, during and after transplanting. Some of these are as follows:

- Exposure of bare roots to high temperatures, direct sunlight of drying winds between digging and planting.
- Failure to spread roots out during transplanting. (this can cause a condition known as girdling roots).
- Planting root-ball too deep.
- Using unsuitable soil for backfill or failing to firm down the soil after transplanting, resulting in inadequate contact between roots and soil.
- Failure to remove man-made fibre ropes that support the root-ball after transplanting, may result in root girdling that could kill the tree in later years.
- Insufficient supplemental watering after transplanting.

For more information on proper transplanting methods refer to OMAF Factsheet ***Planting Trees in the Landscape***, Adgex 275.

Girdling Stresses

Girdling or strangulation of a tree trunk can be caused when wire fencing, nylon or steel cable (e.g. a clothes line) has been tied around the tree for anchorage. It the wire is left around the tree for a number of years, the bark slowly incorporates the cable, gradually restricting the flow of water and nutrients in the cambium. Similar damage may also occur when guy-wires (that have been used as support after transplanting) become too tight. These wires should be checked every year until they are removed.

Partial girdling of the trunk (especially in young or thin-barked trees) can result when weed-eaters and lawn-mowers are used in close proximity to a tree.

Site Alterations

Increasing the soil level by more than 8 cm around an established tree will reduce the oxygen and moisture supply to the roots. Eventually decline will occur. If soil has to be added because of landscaping needs, the tree can be saved by placing a radiating grid of drainage tile and gravel around the tree. When the fill is less than 45 cm deep, drainage tile will be adequate. However, when the fill is over 45 cm, a layer of gravel 20 to 30 cm deep should be laid along with the drainage tile.

Salt Damage

Trees growing along a street or side walk may be stressed by deicing salt spray and by salt build-up in the soil. Damage increases with closer proximity to the road and damage will be more severe on the foliage facing the road. When salt levels rise in the soil, trees will be subjected to a greater degree of moisture stress or physiological drought. In general, high salt levels can cause root burning and decreased root function, resulting in symptoms of drought and nutrient stress in the crown. Deciduous trees that have salt damage will have unopened buds, twig dieback and tufted growth on the exposed side. If salt damage is suspected a soil sample should be taken and tested for salt levels by an accredited laboratory.

Fertilizers and rotting organic matter are other sources of soluble salts.

Pesticide Damage

The severity of pesticide damage will vary with the chemical involved, its concentration and the duration of exposure. Herbicides applied to a lawn or garden may affect a nearby tree. Symptoms may include discolored leaves, twigs dieback, reduced growth, distortion of leaves and twigs.

Soil sterilants (long term herbicides) applied to patios or driveways may be absorbed into trees roots and affect crown growth. These herbicides can persist for more than one growing season.

Application of pesticides to trees when temperatures are above 27 ^{0}C may cause leafscorch or other types of injury.

The insecticide carbaryl when applied within 3 weeks of flowering will cause fruit thinning.

Dimethoate (a systemic insecticide) when applied to the same area of bark year after year will leave a dark ring and girdling injury may occur. This problem may often be seen on birch trees that have been sprayed for Birch leafminer.

Other Stresses

Gas leaking from underground pipes causes root damage. Natural gas does not normally cause direct injury to trees, but may cause damage by displacing soil oxygen needed for root growth. Chlorinated water from swimming pools or hot tubs may also damage nearby tree roots.

GETTING PROFESSIONAL HELP FOR YOUR TREES

If you require further assistance in diagnosing the problem on your tree, you may want to consult a professional arborist or speak with the staff at your local nursery or garden centre.

Samples can also be mailed or brought in person to;

The Pest Diagnostic and Advisory Clinic
Department of Environmental Biology
University of Guelph
Guelph, Ontario. N1G 2W1
Phone: (519) 824-4120 Ex 2700

There is a fee for this service. For more information please contact the clinic or local Ontario Ministry of Agriculture and Food (OMAF) office.

ADDITIONAL INFORMATION

For more information on trees, the following Factsheets and publications are available at no charge from your nearest county OMAF office or by writing to:

The Consumer Information Centre
Ontario Ministry of Agriculture and Food
801 Bay Street
Toronto, Ontario
M7A 2B2

Publications

Pub. 64 *Insect and Disease control in Home and Garden*
Pub. 483 *Pruning Ornamentals*

Factsheets

Order No.	Agdex No.	
89-115	275	**Planting Trees in the Landscape**
86-038	275/17	**Selecting Trees for Landscape Plantings**
83-040	270/542	**Fertilizer Trees and Shrubs in the Landscape**
89-124	500	**Soil and Fertilizing Information for Home Lawns and Gardens**

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